OHMEDA GC & IC INC.

6/Calibration and Adjustments

CAUTION: Use the static control work station (Part No. 0175-2311-000) to help ensure that static charges are safely conducted to ground and not through static sensitive devices.

NOTE: The Intensive Care and General Care Incubators are similar in design. Calibration of the Intensive Care and General Care Incubators is covered in this section. When the wording "IC Incubator Only" appears in a step title the entire step does not pertain to the GC Incubator. In addition some sections are written for only the IC or the GC Incubator.

Note: The three Intensive Care Incubators are referred to in this procedure as the 37.5 IC Incubator, the 39.0 IC Incubator, and the 41.0 IC Incubator.

The Control Temperature range for the 37.5 IC Incubator is from 28.0 to 37.5 degrees C.

The Control Temperature range for the 39.0 IC Incubator is from 28.0 to 39.0 degrees C.

The Control Temperature range for the 41.0 IC Incubator is from 28.0 to 41.0 degrees C.

Refer to the Specifications Section for more information.

Note: Allow up to 20 seconds for the alarm light to cancel for some procedures.

A. Static Control Integrity Check

Check the conductive bumpers (located on the front upper hood retainer) and neoprene wipers (located on hood retainers) for less than 100K ohms of resistance.

B. Isolation and Shielding Check

1. Patient Probe Isolation Check

Use an ohmmeter and check for infinite resistance between the metal disc and the mini-connector tip and sleeve of the patient probe. A very low resistance reading means the patient probe is not isolated and must be replaced.

2. EMI Shielding Check

Use an ohmmeter and measure the resistance between the metal retainer on the left front bed latch and the ground pin of the power cord. The resistance should be less than 100K ohms.

C. Power Supply Board Check (Board Layout-Section 12, Schematic Section 13)

WARNING: When performing service procedures with the power connected, extreme care must be taken to avoid direct or indirect contact with any of the electrical circuitry because of existing shock hazard.

1. Control Unit Access

a. Place the power switch in the OFF position.
b. Disconnect the power cord from the power source.
c. Remove the two screws which mount the control unit to the incubator.
d. Slide the control unit out. For easy removal make sure the power cord is not wrapped tightly on the cord holder.

Table 6-1

Test Points on Power Supply Bd.	D.C. Voltage
1. TP 7 (earlier version only)	+8.0V (Min +7 Max +12) (Unregulated voltages)
2. TP 8	5 ± 0.2V
3. TP 4	-9 ± 1V
4. TP 6	+9.6 ± 0.05V
Adjust pot R18 on P.S. Bd. if necessary	
5. TP 5	5 ± 0.2V
6. With the meter attached to TP 5, remove the power cord from the power source and check for 5 ± 0.2V. (This checks the standby battery supply).	

2. Power Supply Voltage Check

a. Connect the negative lead of a DMM to TP-9 (ground) on the power supply board.
b. Connect the positive lead of a DMM to the test points listed in Table 6-1, one at a time.
c. Connect the power cord to the proper power source and turn the power switch ON. Allow the unit to warm up for five minutes before taking readings. Verify that the supply voltage is present at all test points. Switch OFF the power before making connections to the other test points (line voltage is still present at some points).
d. Disconnect the power cord and then disconnect the DMM from the power supply board.

D. Temperature Simulator Connection

(Figure 5-1)

WARNING: Disconnect power to the incubator before connecting or disconnecting the temperature simulator.

NOTE: Allow the incubator to warm up for five minutes before performing this procedure. Incubators with a control temperature range of 28 degrees C to 39 or 41 degrees C require different procedures which have been included and noted. Perform the alternate steps required when necessary. Determine the incubators control temperature range before starting this procedure.

1. Disconnect the incubator power cord from the electrical receptacle.

2. Connect the round 14-pin connector (P15) on the test cable to J-15 at the rear of the temperature simulator.

3. Remove the cable connector P-2 from J-2 on the power supply board of the incubator.

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4. Connect the 4-conductor female Mate-N-Lok connector from the test cable into J-2 of the power supply board.

5. Reconnect the cable connector P-2 which was disconnected above, into the female Mate-N-Lok connector on the test cable.

6. Disconnect P-5 from J-5 on the control board and set aside.

7. Connect the 10-pin Make-N-Lok connector on the test cable to the J-5 connector on the control board of the incubator.

8. Connect the single red wire (audible alarm line) on the test cable to pin 3 of P-5.

9. Connect the power cord to an appropriate power source and turn the incubator power switch to the ON position.

E. Air Safety Circuit Check and Adjustment (Schematic Section 13)

1. DVM Accuracy Check

a. Place the air safety switch of the temperature simulator in the DVM/CAL position.

NOTE: If the incubator alarm activates press the alarm silence touch switch.

b. Connect the DVM to connectors J-8 and J-9 (CALS RES) on the back of the temperature simulator.
c. For the B & K Model 2815 meter (or equivalent) use the 100K range and the ohms function position. The resistance reading should be between 39.8K ohms and 40.6K ohms (nominal 40.2K ohms).

IMPORTANT: If your meter is out of calibration return it to the manufacturer for calibration. The air safety circuit check and calibration depends on the accuracy of the DVM.

2. Air Safety Check:

a. Connect the DVM to connectors J-7 and J-8 (AIR SAFETY) on the back of the temperature simulator.
b. Place the selector switch of the temperature simulator in the I1 position, the air safety switch in the INC position, and the alarm adjust control fully CCW.
c. Verify that the incubator is in the manual mode (IC Incubator only).
d. Set the CONTROL TEMP to 33.0 degrees C.
e. If no alarm is present proceed to the next step.

NOTE: If an alarm is present the alarm must be cancelled before the check procedure can be completed. First refer to the calibration procedure in step 4 to cancel the air safety alarm. If the alarm does not cancel refer to Section F, A/D Converter Check and Adjustment. After silencing the alarm return back to this section and continue with this procedure. If the alarm is still present after completing Section F, refer to the troubleshooting section.

3. Heater ON Check:

a. Set the incubator CONTROL TEMP to 37.5 degrees C.
b. Verify that the heater lamp indicates full heat. This may take approximately 20 seconds.
c. Verify that no alarm condition is present at this time.
d. SLOWLY rotate the ALARM ADJ control clockwise until the alarm just trips. Be careful not to overshoot the alarm trip point.
e. After the SYSTEM FAIL/OVERTEMP alarm activates, switch the air safety switch to the DVM position.
f. Verify the resistance measurements as follows:

1. The resistance measurement for the 37.5 IC Incubator should be between 50,700 ohms and 50,900 ohms. If not, go to the Calibration Procedure.

2. The resistance measurement for the 39.0 IC Incubator should be between 47,760 ohms and 47,960 ohms. If not, go to the Calibration Procedure.

3. The resistance measurement for the 41.0 IC Incubator should be between 43,740 ohms and 43,940 ohms. If not, go to the Calibration Procedure in step 5.

NOTE: If you repeat the test make sure the heater lamp indicates full heat. Replace the power supply board when the specified resistance readings are not attainable after calibration.

4. Reset with Heater ON - Operational Check

a. Place the air safety switch on the simulator in the incubator (INC) position.
b. Verify that the SYSTEM FAIL/OVERTEMP alarm activates.
c. SLOWLY rotate the ALARM ADJ control counterclockwise until the alarm just resets. Listen for the relay to reset and watch for the alarm light to extinguish.
d. If steps 2, 3, and 4 are completed as stated no calibration is required. Proceed to the A/D Converter Check & Adjustment in step F.

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5. Calibration Procedure

a. Place the air safety switch in the DVM position.
b. Set the incubator CONTROL TEMP to:
1. 37.5 degrees C for the 37.5 IC Incubator.
2. 39.0 degrees C for the 39.0 IC Incubator.
3. 41.0 degrees C for the 41.0 IC Incubator.

c. Rotate the ALARM ADJ control for a DVM resistance reading of:
1. 50,800 ohms for the 37.5 IC Incubator.
2. 47,860 ohms for the 39.0 IC Incubator.
3. 43,840 ohms for the 41.0 IC Incubator.

d. Place the air safety switch in the incubator (INC) position.

IMPORTANT: There are two versions of the power supply board which have been used in incubators. You must determine which of the two versions you have before adjusting R17. The newer board has two physical features that distinguish it from the older board. All test points (TP) are located along the top edge of the new board for easy access. Also both adjustment potentiometers (R17 and R18) are located together, next to the test points.

Older Version Power Supply Board
ALARM PRESENT: The following adjustment procedure is for the older version of the power supply board. If the SYSTEM FAIL/OVERTEMP alarm is present adjust R17 on the power supply board clockwise (CW) to reset the alarm. Wait for the heater lamp to indicate full heat. Slowly adjust R17 on the power supply board counterclockwise (CCW) until the alarm just activates. Replace the power supply board if adjustment is not possible.

ALARM NOT PRESENT: The following adjustment procedure is for the older version of the power supply board. If the SYSTEM FAIL/OVERTEMP alarm is not present wait for the heater lamp to indicate full heat then slowly adjust R-17 on the power supply board counterclockwise (CCW) until the alarm just activates. Replace the power supply board if adjustment is not possible.

Newer Version Power Supply Board
ALARM PRESENT: The following adjustment procedure is for the newer version of the power supply board. If the SYSTEM FAIL/OVERTEMP alarm is present adjust R17 on the power supply board counterclockwise (CCW) to reset the alarm. Wait for the heater lamp to indicate full heat. Slowly adjust R17 on the power supply board clockwise (CW) until the alarm just activates. Replace the power supply board if adjustment is not possible.

ALARM NOT PRESENT. The following adjustment procedure is for the newer version of the power supply board. If the SYSTEM FAIL/OVERTEMP alarm is not present wait for the heater lamp to indicate full heat then slowly adjust R17 on the power supply board clockwise (CW) until the alarm just activates. Replace the power supply board if adjustment is not possible.

e. Perform steps 2, 3, and 4 of Section E. Air Safety Circuit Check and Adjustment.

F. A/D Converter Check and Adjustment (Control Board Layout Section 12)

1. A/D Converter Check

a. Place incubator in the manual mode (IC Incubator Only).
b. Place the selector switch in position I1, the air safety switch in the INC position, and the ALARM ADJUST control fully counterclockwise (CCW).
c. Press PATIENT TEMP and press and hold the increase touch switch. Verify that the digital display indicates 31.0 ± 0.1 degrees C, if not go to step 2, A/D Zero Adjustment.
d. Select simulator switch position I2.
e. Press PATIENT TEMP and press and hold the increase touch switch. Verify that the digital display indicates 39.0 ± 0.1 degrees C, if not go to step 3, A/D Gain Adjustment, if correct proceed to step 4, A/D Converter Final Check.

2. A/D Zero Adjustment

a. Place the selector switch in position I1, the air safety switch in the INC position, and the ALARM ADJUST control fully counterclockwise (CCW).
b. Press and hold the increase touch switch.
c. Adjust potentiometer R17 on the control board for a digital display of 31.0 ± 0.1 degrees C.
d. Return to Section F1, A/D Converter Check, and repeat steps d and e.

3. A/D Gain Adjustment

a. Place the selector switch in position I2.
b. Press and hold the increase touch switch.
c. Adjust potentiometer R16 on the control board for a digital display of 39.0 ±0.1 degrees C.
d. Repeat Section F2, A/D Zero Adjustment, and Section F3, A/D Gain Adjustment, until both the A/D Zero and A/D Gain are properly adjusted.

4. A/D Converter Final Check

a. Select simulator switch position I3.
b. Press the PATIENT TEMP touch switch.
c. Press and hold the increase touch switch.
d. Verify that the digital display indicates 33.0 ± 0.1 degrees C, if not return to Section F. A/D Converter Check and Adjustment.

G. Calibration Resistor Check

1. Press the PATIENT TEMP touch switch.

2. Press and hold the CONTROL TEMP decrease touch switch. The displayed temperature should be 37.3 ± 0.1 degrees C, if not return to Section F. A/D Converter Check and Adjustment.

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H. Final Incubator Checks with Temperature Simulator:

1. PATIENT-TEMP/SENSOR Alarm Check (IC Incubator Only)

a. Set temperature simulator switch to position I3.
b. Press the MANUAL MODE touch switch.
c. Set the control temperature for 37.5° C
d. Press the SERVO MODE touch switch.
e. Set the control temperature for 37.5° C.
f. Verify that the PATIENT-TEMP/SENSOR alarm activates (both audible and visual) within 20 seconds (24 seconds for the 50 Hz models).
g. Verify that the heater light remains ON or flashing.
h. Press the ALARM SILENCE touch switch.

2. Check for Open Patient Probe Alarm (IC Incubator Only)

a. Press the PATIENT TEMP touch switch.
b. Select simulator switch position I4.
c. Verify that the SYSTEM FAIL/OVERTEMP alarm (both audible and visual) activates. The PATIENT-TEMP/SENSOR alarm light should still be lit.
d. Verify that the simulator heater lamp is OFF.
e. Verify that the displayed temperature is less than 5 degrees C or HH.H is indicated.
f. Select simulator switch position I5.
g. Verify that the alarms reset, and that the simulator heater lamp is ON or flashing.

3. Check for Shorted Patient Probe Alarm (IC Incubator Only)

a. Select simulator switch position I6
b. Verify that the SYSTEM FAIL/OVERTEMP alarm (both audible and visual) activates.
c. Press the ALARM SILENCE touch switch.
d. Verify that the simulator heater lamp is OFF.
e. Verify that the displayed temperature is greater than 45 degrees C or HH.H is indicated.

4. Inlet and Outlet Sensor Temperature Display Check

a. Place the incubator in the MANUAL MODE (IC Incubator Only).
b. Verify that all alarm conditions are cancelled.
c. Press the ENVIRONMENTAL TEMP touch switch.
d. With the simulator switch in position I6, verify an ENVIRONMENTAL TEMP display of 35.0 ± 0.1 degrees C.
e. Press and hold the increase touch switch to display the inlet wall temperature.
f. Verify that the displayed temperature is 39.0 ± 0.1 degrees C.
g. Press and hold the decrease touch switch to display the outlet wall temperature.
h. Verify that the displayed temperature is 31.0 ± 0.1 degrees C.

5. Inlet Wall Temperature Greater than 45 degrees C Alarm Check for the 37.5 IC Incubator

a. With the simulator switch in position I6, place the incubator in MANUAL MODE (IC Incubator Only) and set the CONTROL TEMP to 37.5 degrees.
b. Press the ENVIRONMENTAL TEMP touch switch
c. Verify that the simulator heater lamp is ON or flashing.
d. Select simulator switch position I7.
e. Verify that the SYSTEM FAIL/OVERTEMP alarm (both audible and visual) activates.
f. Press the ALARM SILENCE touch switch.
g. Press the hold the increase touch switch to display the inlet wall temperature.
h. Verify that the displayed temperature is greater than 45 degrees C and that the simulator heater lamp is OFF.
i. Select simulator switch position I8.
j. Verify that the SYSTEM FAIL/OVERTEMP alarm resets and the simulator heater lamp is ON or flashing (may take approximately 20 seconds to activate).

6. Inlet Wall Temperature Greater than 45.0C Alarm Check for the 39.0 and 41.0 IC Incubators.

Note: When the control temperature is between 37.6 degrees C and 39.0 or 41.0 degrees C., in the manual mode, the alarms are increased by the CONTROL TEMP minus 37.5.

a. With the simulator switch in position I6, place the incubator in the MANUAL MODE (IC Incubator Only) and set the CONTROL TEMP to 38.5 degrees C.
b. Press the ENVIRONMENTAL TEMP touch switch.
c. Verify that the simulator heater lamp is ON or flashing.
d. Select simulator switch position I12.
e. Verify that the SYSTEM FAIL/OVERTEMP alarm (both audible and visual) activates.
f. Press the ALARM SILENCE touch switch.
g. Press the hold the increase touch switch to display the inlet wall temperature.
h. Verify that the displayed temperature is greater than 46.5 degrees C and that the simulator heater lamp is OFF.
i. Select simulator switch position I8.
j. Verify that the SYSTEM FAIL/OVERTEMP alarm resets and the simulator heater lamp is ON or flashing (may take approximately 20 seconds to activate).

7. Environmental Temperature Greater Than 39 degrees C Alarm Check for the 37.5 IC Incubator

a. Select simulator switch position I9.
b. Verify that the SYSTEM FAIL/OVERTEMP alarm (both audible and visual) activates.
c. Press the ALARM SILENCE touch switch.
d. Verify that the ENVIRONMENTAL TEMP display is greater than 39 degrees C and that the simulator heater lamp is OFF.

8. Environmental Temperature Greater Than 39.0C Alarm Check for the 39.0 and 41.0 IC Incubator

Note: When the control temperature is between 37.6 degrees C and 39.0 or 41.0 degrees C., in the manual mode, the alarms are increased by the CONTROL TEMP minus 37.5.

a. Select simulator switch position I13.
b. Verify that the SYSTEM FAIL/OVERTEMP alarm (both audible and visual) activates.
c. Press the ALARM SILENCE touch switch.
d. Verify that the ENVIRONMENTAL TEMP display is greater than 40.5 degrees C and that the simulator heater lamp is OFF

9. Check for SERVO MODE Low End Alarm (IC Incubator Only)

a. Select simulator switch position I10.
b. Place the incubator in the SERVO MODE.
c. Press the PATIENT TEMP touch switch and record the temperature displayed.
d. Press the CONTROL TEMP touch switch and adjust the control temperature 1.2 degrees C below the noted patient temperature.
e. Verify that the PATIENT-TEMP/SENSOR alarm (both audible and visual) activates in 20 seconds (24 seconds for 50 Hz models).
f. Verify that the heater is OFF.
g. Increase the CONTROL TEMP 0.4 degrees C. Be careful not to overshoot
h. Verify that the alarm cancels.

10. Check for SERVO MODE High End Alarm (IC Incubator Only)

a. Select simulator switch position I11.
b. Press the PATIENT TEMP touch switch and record the temperature displayed.
c. Press the CONTROL TEMP touch switch and adjust the control temperature 1.2 degrees C above the noted patient temperature. Be careful not to overshoot.
d. Verify that the PATIENT-TEMP/SENSOR alarm (both audible and visual) activates in 20 seconds (24 seconds for 50 Hz models).
e. Decrease the CONTROL TEMP 0.4 degrees C. Be careful not to undershoot.
f. Verify that the alarm cancels and the simulator heater lamp is ON or flashing. This may take approximately 20 seconds

I. Temperature Simulator Removal

1. Switch the power switch on the incubator to the OFF position

2. Disconnect the incubator power cord from the power source.

3. Remove the single red wire of the test cable from pin 3 of P-5

4. Remove the test cable connector from the control board connector J-5.

5. Reconnect P-5 to the J-5 connector on the control board.

6. Remove the test cable connector which is connected to J-2 on the power supply board.

7. Reconnect P-2 to the J-2 connector on the power supply board.

J. Air Safety Checks

1. Air Safety Thermistor Resistance Check

a. Connect the DVM between the cable end of P2-2 and P2-3 (2 inside pins of 4 pin connector P-2).
b. Check for an open (infinite resistance) or low resistance) condition. Typical resistance values for the air safety sensor are shown in the Appendix Page A-4. If an open or short condition exists check the air safety mate-n-lok connector located behind the control panel. Also check the cable continuity between J-2 and the mate-n-lok connector.
c. Place your finger on the air safety thermistor located behind the outlet wall sensor (front wall sensor).
d. Verify a change in the resistance measurement as the thermistor temperature changes. If the resistance does not change or is out of specification change the air safety sensor.
e. Disconnect the DVM and reconnect P-2 to J-2 on the power supply board.

2. Final Air Safety Check (37.5C Incubator Only)

NOTE: This test must be conducted in an ambient room temperature between 68 and 80 degrees F.

a. Allow the incubator to stabilize at a room temperature between 68 and 80 degrees F.
b. Reconnect the power cord and switch the power on.
c. Set the incubator to a control temperature of 37.5C in the manual mode (IC Incubator Only).
d. Set the humidity control to minimum humidity.
e. Place the incubator in the environmental temperature mode.
f. Allow the incubator to heat to 37.5C.
g. Verify that an air safety alarm does not occur during this initial warm up period. A 39.0 degree C environmental temperature alarm may occur during this test. The 39.0 degree C alarm may be distinguished from the air safety alarm by observing the environmental temperature at which the alarm condition cancels. If the alarm cancels at an environmental temperature of exactly 38.8 degrees C the alarm was the 39.0 degree environmental temperture alarm. If the alarm cancels at an environmental temperature lower than 38.8 degrees C the alarm was an air safety alarm.
h. Allow the incubator to stabilize at 37.5C
i. Verify an ENVIRONMENTAL TEMP display of 37.5 ± 0.5C.

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K. Patient Probe

1. **Examination**

a. Examine the patient probe, lead wire and miniature phone plug for damage and wear.
b. Connect the patient probe to the incubator.
c. Place the incubator in the MANUAL MODE.
d. Press the PATIENT TEMP touch switch.
e. Gently flex the patient probe lead wire and watch for an HHH temperature display. An open or shorted patient probe is indicated by an HHH temperature display. Replace the patient probe if an open or shorted condition exists.

2. **Accuracy Check**

a. Fill a styrofoam cup with warm water (approximately 37.0C)
b. Attach the patient probe to the calibration thermometer (OMP #0217-2999-800) tip using a rubber band to hold it in place. The metal disk of the probe must be contacting the thermometer.
c. Place the patient probe and calibration thermometer in the cup of water. Gently, stir the water with the thermometer while performing the next step.
d. Check that the thermometer and temperature displayed in the patient temperature mode agree within ±0.5C.

L. Control Unit Closure and Static Control Work Station Removal

1. Slide the control unit in. Keep the control unit to the left side as far as possible.

2. Replace the two screws which mount the control unit to the incubator cabinet.

3. Remove the wrist strap and ground cords. Place them in the static control work station pouches.

4. Fold up the static control work station.

M. IC Incubator Control Unit Check

1. Connect the incubator power cord to an appropriate power source (see rating plate for proper voltage, etc.). Place the power switch in the ON position and verify the following:

a. The unit is operating in the MANUAL MODE and the respective yellow indicator lamp is lit.
b. The CONTROL TEMP is at 33.0C.

2. Press the ALARM SILENCE touch switch and verify that all the indicator lamps are lit with the exception of the SERVO MODE indicator. The display should indicate three number eights (88.8).

3. Connect the patient temperature probe to the incubator.

4. Press the SERVO MODE touch switch and verify the following.

a. The yellow indicator light for the servo mode is lit.
b. A short beep tone is heard from the alarm.
c. The CONTROL TEMP is at 36.5C.
d. The PATIENT-TEMP/SENSOR alarm will activate if the patient temperature is more than 1C from the control temperature.

5. Press the ALARM SILENCE touch switch.

6. Remove the patient temperature probe from the connector and verify that the SYSTEM FAIL/OVER-TEMP alarm sounds and the red indicator lamp is lit.

7. Press the ALARM SILENCE touch switch and verify that the alarm is silenced and the indicator lamp remains ON.

8. Connect the patient temperature probe and verify that the SYSTEM FAIL/OVERTEMP indicator lamp is extinguished.

9. Press the ENVIRONMENTAL TEMP touch switch and verify that the respective indicator lamp is lit and the temperture displayed is between 20.0C and 40.0C.

10. Press the PATIENT TEMP touch switch and verify that the respective indicator lamp is lit and the temperature displayed is between 20.0C and 40.0 C.

11. Hold the patient temperature probe between your fingers and verify that the displayed temperature changes.

12. Press the MANUAL MODE touch switch and verify that a short beep tone is heard and the respective indicator lamp is lit.

13. Press the CONTROL TEMP touch switch and verify that the respective indicator lamp is lit.

14. Press and hold the CONTROL TEMP ↑ increase touch switch and verify that the maximum manual control temperature attainable is 37.5C, 39.0C or 41.0C depending on the type of incubator you have.

15. Press the CONTROL TEMP touch switch.

16. Press and hold the CONTROL TEMP ↓ decrease touch switch and verify that the minimum manual control temperature attainable is 28.0C.

17. Press the CONTROL TEMP touch switch and verify that the control temperature may not be increased or decreased approximately 30 seconds (36 seconds for 50 Hz models) after pressing the CONTROL TEMP touch switch.

18. Press the SERVO MODE touch switch. If necessary, press the ALARM SILENCE touch switch.

19. Press the CONTROL TEMP touch switch.

20. Press and hold the CONTROL TEMP ↑ increase touch switch and verify that the maximum servo control temperature attainable is 37.5C.

21. Press and hold the CONTROL TEMP ↓ decrease touch switch and verify that the minimum servo control temperature attainanble is 35.0C.

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N. GC Incubator Control Unit Check

1. Connect the incubator power cord to an appropriate power source, (see rating plate for proper voltage etc.) and switch the power ON. The CONTROL TEMP should be at 33.0C.

2. Press the ALARM SILENCE touch switch and verify that all the indicator lamps are lit. The display should indicate three number eights (88.8).

3. Connect the patient temperature probe to the incubator.

4. Press the ENVIRONMENT TEMP touch switch and verify that the respective indicator lamp lights and the temperature displayed is between 20.0C and 40.0C.

5. Press the PATIENT TEMP touch switch and verify that the respective indicator is lit and the temperature displayed is between 20.0C and 40.0C.

6. Hold the patient temperature probe between your fingers and verify that the displayed temperature changes.

7. Press the CONTROL TEMP touch switch and verify that the respective indicator lamp is lit.

8. Press and hold the CONTROL TEMP ↑ increase touch switch and verify that the maximum control temperature attainable is 37.5C.

9. Press the CONTROL TEMP touch switch.

10. Press and hold the CONTROL TEMP ↓ decrease touch switch and verify that the minimum control temperature attainable is 28.0C.

11. Press the CONTROL TEMP touch switch and verify that the control temperature may not be ↑ increased or ↓ decreased approximately 30 seconds (36 seconds for 50 Hz models) after pressing the CONTROL TEMP touch switch.

O. Inlet and Outlet Sensor Check

1. Rotate the incubator hood to the fully retracted position.

2. Press the ENVIRONMENTAL TEMP touch switch.

3. Press and hold the CONTROL TEMP ↑ increase touch switch. The displayed temperature is the inlet wall (rear wall) surface sensor temperature.

4. Place your index finger on the back inlet wall surface sensor and verify a change in the displayed temperature.

5. Press and hold the CONTROL TEMP ↓ decrease touch switch. The displayed temperature is the outlet wall (front wall) surface sensor temperature.

6. Place your index finger on the front outlet wall surface sensor and verify a change in the displayed temperature.

7. Close the incubator hood.

P. Calibration Resistor Check

1. Press the PATIENT TEMP touch switch.

2. Press and hold the CONTROL TEMP ↓ decrease touch switch. The displayed temperature should be 37.3C ± 0.1C. When the displayed temperature is 37.3C ± 0.5C or greater a SYSTEM FAIL/OVERTEMP alarm activates.

Q. IC Incubator Power Failure Alarm and Memory Test

NOTE: The battery (located on the power supply board) must be in a fully charged condition to pass the 10 minute test or partially charged to pass the two minute test.

Replace the battery every 2 years or when it is defective. There is no maintenance required for the battery.

1. Place the incubator in the SERVO MODE and adjust the control temp for 35.5C.

2. Place the Incubator in the MANUAL MODE and adjust the CONTROL TEMP for 30.5C.

3. Place the incubator in the SERVO MODE.

4. Disconnect the power cord (do not turn the power switch OFF) and verify that the power failure alarm sounds and all display indicators are extinguished. Allow the alarm to sound for 2 minutes.

WARNING: If the power failure alarm is tested for 10 minutes the incubator must be connected to the appropriate power source and operated for 24 hours to recharge the battery before allowing the incubator to be occupied by a patient.

5. Reconnect the power cord and verify that the incubator returns to a control temperature of 35.5C in the SERVO MODE of operation.

6. Place the incubator in the MANUAL MODE and verify a control temperature of 30.5C.

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R. GC Incubator Power Failure Alarm and Memory Test

NOTE The battery (located on the power supply board) must be in a fully charged condition to pass the 10 minute test or partially charged to pass the two minute test.

Replace the battery every 2 years or when it is defective. There is no maintenance required for the battery.

1. Record the control temperature.

2. Disconnect the power cord (do not turn the power switch OFF) and verify that the power failure alarm sounds and all display indicators are extinguished. Allow the alarm to sound for 2 minutes

WARNING: If the power failure alarm is tested for 10 minutes the incubator must be connected to the appropriate power source and operated for 24 hours to recharge the battery before allowing the incubator to be occupied by a patient.

3. Reconnect the power cord and verify that the incubator returns to the recorded control temperature.

S. IC Incubator Audible Alarm Timer Check

1. With the patient probe disconnected, press the SERVO MODE touch switch. Verify an audible alarm and the SYSTEM FAIL/OVERTEMP indicator is lit.

2. With a stopwatch begin timing the audible alarm silence when the ALARM SILENCE touch switch is pressed.

3. Wait approximately 13 minutes and record the time that the audible alarm activates. The alarm should sound in 13 ± 2 minutes.

T. Operational Check

CAUTION: Placing the incubator close to external heating and cooling devices can cause incorrect temperature readings.

1. Place the incubator in an area that is relatively free from air currents and has an ambient temperature between 70F and 85F.

2. Place a calibrated mercury thermometer about four inches above the center of the mattress.

3. Connect the power cord to the power source.

4. Switch the incubator power ON.

5. Adjust the CONTROL TEMP to 34C in the MANUAL MODE. Set the humidity control to minimum with no water in the reservoir.

6. Allow approximately 1 hour warmup time. (May need more or less time depending on ambient temperature.)

7. Compare the temperature on the mercury thermometer (the air temperature in incubator) with the displayed environmental temperature. The temperatures should be 34 ± 1.0C

U. Servo Mode Operational Check (IC Incubator Only)

1. Disconnect the main test cable and ground wire from the temperature simulator.

2. Connect a 2 conductor cable with 1/8 inch miniature phone plugs (obtain locally) on each end to the temperature simulator and to the patient probe jack on the incubator.

3. Select simulator switch position 111.

4. Press the PATIENT TEMP touch switch and note the temperature displayed.

5. Place the incubator in the SERVO MODE.

6. Adjust the control temperature to 0.5 degrees C above the noted patient temperature.

7. Place the incubator in the MANUAL MODE and set the control temperature to 33.0 degrees C.

8. Use a stop watch and start timing when you place the incubator in the SERVO MODE.

9. After 11 minutes have passed, press the MANUAL MODE touch switch.

10. Verify that the control temperature has increased to 33.3 degrees C.

11. Press the PATIENT TEMP touch switch and note the temperature displayed.

12. Place the incubator in the SERVO MODE.

13. Adjust the control temperature 0.5 degrees C below the noted temperature.

14. Place the incubator in the MANUAL MODE and set the control temperature to 33.0 degrees C.

15. Use a stop watch and start timing when you place the incubator in the SERVO MODE.

16. After 11 minutes have passed, press the MANUAL MODE touch switch.

17. Verify that the control temperature has decreased to 32.7 degrees C.

18. Disconnect the 2 conductor cable from the temperature simulator and the incubator.

6/Calibration and Adjustments

V. Phototherapy Lamp Check

1. Check the overall condition of the phototherapy lamp and controller. The lamp cover should be free of cracks or other signs of deterioration.

2. When the Phototherapy Lamp is mounted in the upright the swivel mount should hold the lamp in position.

3. Check the phototherapy control unit for bent power plug pins.

4. Check the control unit power cord connector for bent pins (earlier version only).

5. Check the strain relief on the power cord.

6. Check the power cord for cuts or worn insulation and replace it if necessary.

7. Connect the power cord from the phototherapy lamp housing to the controller (earlier version only).

8. Connect the incubator to the appropriate power source. Install the controller into one of the accessory slide positions next to the incubator main control unit. Check for easy installation and removal.

9. Switch the phototherapy controller power ON and verify the lamps light.

W. Radiant Warmer Check

Refer to the Radiant Warmer Operation and Maintenance Manual for the Check-Out Procedure (Section 4.3)

X. Electrical Safety Check

1. Power Cord Inspection

a. Examine the power cord for damage and wear.

b. Examine the power plug for loose or bent pins. Replace the power cord if the cord or plug is damaged.

2. Fuses

Check for the correct value and type of fuses on the incubator and phototherapy lamp control unit if present.

3. Power Outlets and Accessory Outlets

Check for correct polarity and proper tension on all outlets present on the incubator.

Y. Ground Resistance Check

Perform a ground resistance check on the incubator accessory outlets and each individual electrical accessory. Use a low range ohmmeter or electrical safety analyzer to measure the resistance between the ground pin on the line cord plug and the main control unit accessory outlets, Phototherapy Lamphouse and Phototherapy control unit. Tug and flex each end of the power cord during the measurement. The ground resistance **must** be less than 0.15 ohms. Higher readings may indicate loose or oxidized connections in the power cord or the incubator grounding circuits.

Z. Leakage Current Tests

Perform separate electrical safety and leakage current tests on the incubator and each electrical accessory. Perform the test on each individual device, not as a system.

Measure the leakage current in all wiring configurations both ON and OFF, grounded and ungrounded, and normal and reverse polarities. Make sure the heater is ON full during the test. Set the Control Temperature to 37.5C on the incubator and set the intensity control to maximum on the radiant warmer.

Use the leakage current tester OMP #0175-2284-000 and digital multimeter (DMM) for the following procedure:

1. Connection (Figure 6-1)

a. Connect the device under test to the outlet on the leakage current tester.

b. Make sure the polarity switch on the leakage tester is in the OFF Position then plug the line cord into a grounded 115-120 volt 60 Hz wall outlet.

c. Connect the positive lead of the DMM to the positive + METER OUT output.

d. Connect the negative lead of the DMM to the negative - METER OUT output.

e. Set the DMM on the millivolt scale.

f. Connect one end of the test cable to the EXTERNAL GROUND jack on the Leakage Current Tester.

g. Use the other end of the test cable (needle probe tip) to contact the exposed conductive surface of the device under test.

2. Normal Polarity Leakage Current Test

a. Place the polarity switch of the Leakage Current Tester in the NORMAL position. (This is in the grounded mode).

b. Switch ON the power of the device under test.

c. Measure the voltage on the DMM in millivolts. The millivolt reading is directly related to leakage current in microamps, (i.e., 100 mv is equivalent to a leakage current of 100 ua).

d. Record the leakage current measured in the appropriate space on the Leakage Current Form.

e. Push the GROUND DISCONNECT switch to measure the ungrounded leakage current.

f. Record this measurement in the appropriate space on the Leakage Current Form.

g. Switch the power switch of the **device under test** OFF and then repeat steps 2c through 2f.

3. Reverse Polarity Leakage Current Test

a. Place the polarity switch on the Leakage Current Tester in the REVERSE position. (This is the grounded mode.)

b. Switch ON the power of the device under test.

c. Measure the voltage on the DMM in millivolts. The millivolt reading is directly related to leakage current in microamps, (i.e., 100 mv is equivalent to a leakage current of 100 ua).

d. Record the leakage current measured in the appropriate space on the Leakage Current Form.

e. Push the GROUND DISCONNECT switch to measure the ungrounded leakage current

f. Record this measurement in the appropriate space on the Leakage Current Form.

g. Switch the power switch of the device under test OFF and then repeat steps 2c through 2f.

/Calibration and Adjustment s

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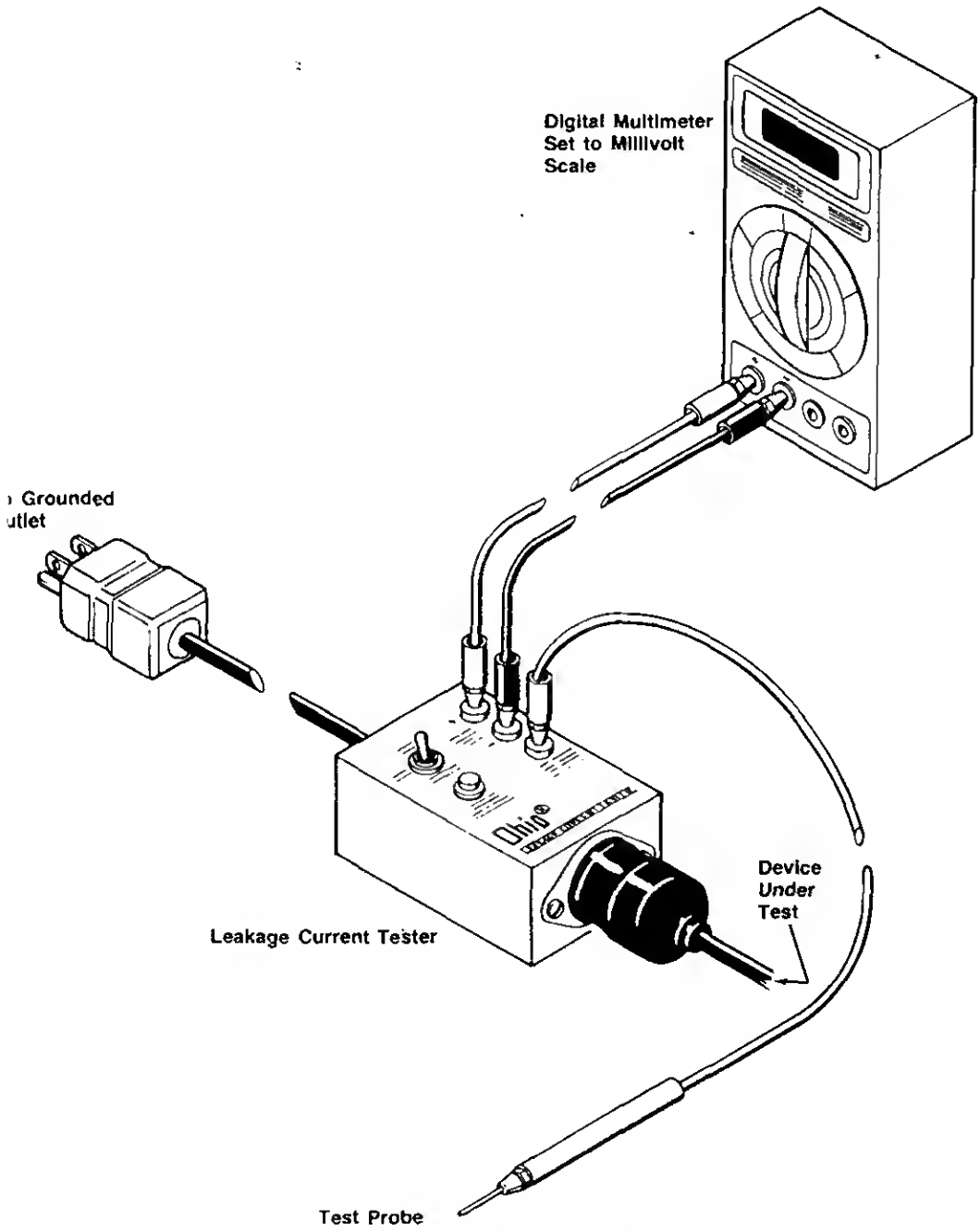

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